

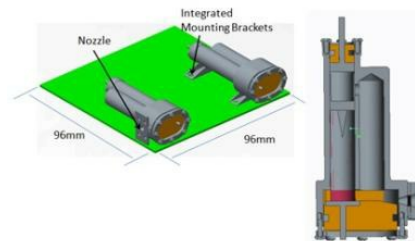
A Green, Safe, Multi-Pulse Solid Motor (MPM) for CubeSats, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

Today's CubeSats lack storable, green, safe propulsion options for complex science missions that may involve large Delta-V changes, proximity operations, and attitude control systems (ACS) for pointing, spin-up, and spin-down. Digital Solid State Propulsion (DSSP) is developing propulsion for CubeSats and will leverage existing research efforts into a new system for NASA. A key technology identified in the phase I solicitation is a Cubesat propulsion system that will enable deep-space CubeSats, which operate outside of Earth's magnetic field, to desaturate reaction wheels. These types of missions cannot use the magnetorquers that are common on the Earth orbiting CubeSats that are popular today. DSSP proposes continued development of a multi-pulse solid rocket motor (MPM), which uses green, safe Electric Solid Propellants (ESPs). This MPM for CubeSats will enable desaturation of reaction wheels on 6U and 12U interplanetary missions with lower mass systems than conventional cold gas based solutions. The baseline performance requirement for this application is estimated to be 0.3 N*sec of impulse per pulse of the thruster in a short time and with low power impact on the satellite. This value is determined from a reaction wheel that has a 30 mN*m*s maximum momentum and a maximum thruster moment arm of 10 cm. DSSP already has a CubeSat Agile Propulsion System (CAPS) at TRL8, a close relative of which deployed safely on SpinSat from the ISS in November 2014, and DSSP's experience at qualifying and delivering flight hardware for that program can be leveraged for NASA. The SpinSat mission has already demonstrated that ESPs are so insensitive to accidental ignition that they can be launched as soft stow cargo to the pressurized section of the ISS and that the new MPM for CubeSats could even potentially be brought aboard the ISS also for later deployment.

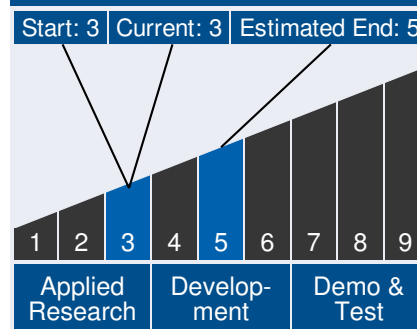


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Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Potential NASA applications include deep space missions (beyond LEO) that utilize 6U CubeSats and larger. Though none have yet flown, many missions of this type are proposed. These include iiSat of MSFC, LWADI of Goddard, and Biosentinel of Ames just to name a few.

To the commercial space industry:

Potential Non-NASA Commercial Applications: We have already teamed with the standard CubeSat bus manufacturer, Pumpkin Inc., and in-space propulsion manufacturer, Moog-ISP, for commercial introduction of our thrusters into the small satellite community. Raytheon Missile Systems is also supporting DSSP for ESP related applications to kill vehicles and boost phase propulsion. Commercially, most interest in these electric solid propellants comes for the oil and oil field services companies. DSSP's smart energetic materials technology was select by "Oil and Gas Innovation" as one of the Top Ten Technologies for 2009. DSSP LLC is in negotiations with Shell Corporation as a "Game Changer" technology for down-hole oil field application.

Management Team (cont.)

Principal Investigator:

- Shae Williams

Technology Areas

Primary Technology Area:

Launch Propulsion Systems (TA 1)

- └ Liquid Rocket Propulsion Systems (TA 1.2)
 - └ RP/LOX Based (TA 1.2.2)
 - └ Low-Cost Nano-Launch Vehicle Stage Engine (Rocket Propellant) (TA 1.2.2.3)

Secondary Technology Area:

In-Space Propulsion Technologies (TA 2)

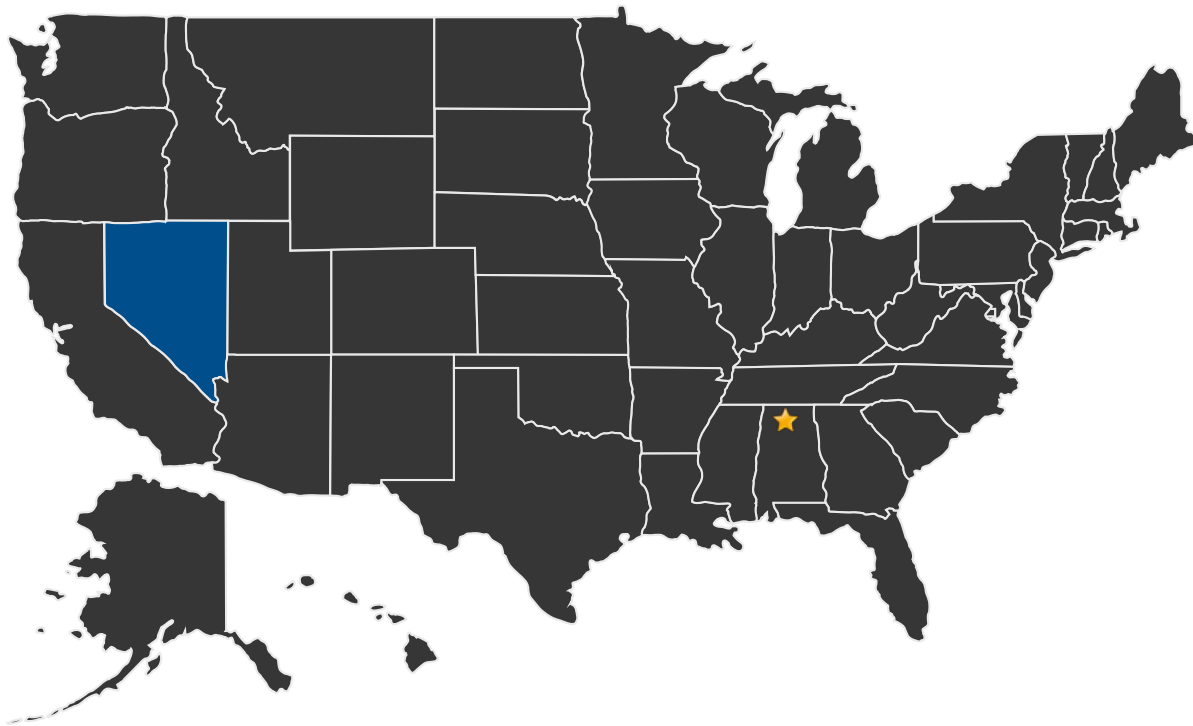
- └ Chemical Propulsion (TA 2.1)
 - └ Solids (TA 2.1.4)

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U.S. WORK LOCATIONS AND KEY PARTNERS



- U.S. States With Work ★ **Lead Center:**
Marshall Space Flight Center

Other Organizations Performing Work:

- Digital Solid State Propulsion, Inc (Reno, NV)

PROJECT LIBRARY

Presentations

- Briefing Chart
 - (<http://techport.nasa.gov:80/file/17752>)

Active Project (2015 - 2017)

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DETAILS FOR TECHNOLOGY 1

Technology Title

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